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GAS ABSTRACTS

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1. GAS INDUSTRY

Expansion

Duff, D. M. NATURAL GAS APPEARS HEADED FOR CONTINUED HIGH-LEVEL EXPANSION. *Oil Gas J.* **49**, 188-189 (1950) *July* 27.

The expansion of the natural gas industry is expected to continue at a high level over the next several years. Major pipe line projects, such as that of Transcontinental Gas Pipe Line Corp. which will deliver some 505,000,000 cubic feet daily into the New York City area, are causing a phenomenal increase in utility sales. Last year utility sales totaled about 3.1 trillion cubic feet and some believe that the current expansion will not level off until annual utility sales reach 4.5 trillion cubic feet or more. Increasingly large sums are being invested in developing storage areas, such as Columbia Gas System's West Virginia area which is being built toward a total of 130 billion cubic feet by next November to provide a possible 1 billion-cubic-foot-per day peak deliverability this coming winter.

J. C. Lane

GAS INDUSTRY TO SPEND 3.14 BILLIONS FOR NEW LINE CONSTRUCTION. *Pipe Line News* **22**, 10-11 (1950) *August*.

The gas industry will spend some $3.14 billion for new and expanded facilities during the five-year period 1950-1954. About $2.75 billion will be spent by the natural gas industry for production, storage, transmission and distribution. Approximately $388 million will be spent by other branches of the gas industry.

J. C. Lane

Light Hydrocarbon Production

Casper, J. C. LIGHT PRODUCTS UP 14.1% OVER FIRST HALF OF 1949. *Oil Gas J.* **49**, 186-187 (1950) *July* 27.

Production at natural gasoline and cycling plants averaged 20,038,000 gallons per day for the first four months of 1950, 14.1% above the average for the same period in 1949. The greatest increase in gallons was in LPG production which averaged 8,159,000 gallons daily or 22.2% above last year's average. The greatest percentage increase was in production of finished gasoline and naphtha which averaged 32.4% above 1949 production.

J. C. Lane

Legal Decisions

Parker, L. T. HIGHER COURT DECISIONS ON GAS INDUSTRY INVOLVE RATES, LABOR AND LIABILITY. *Am. Gas J.* **173**, 32, 34, 47 (1950) *August*.

A recent higher court decision ruled that gas rates fixed by a public service commission can not be made to operate retroactively. Another court ruled that where a company delays emergency service it is directly responsible for injuries acquired as the result of the delay. In another decision it was held that only a jury may decide whether injury resulted from negligence on the part of the customer or the company. In the field of labor, one court ruled that a company is liable for a promise to pay increased wages provided that the employee relied on the promise and continued to work in anticipation of the increase. Consistent with other recent decisions, a court ruled that an injured employee within the scope of the state workmen's compensation act cannot, in addition to receiving compensation, sue and recover damages from the employer.

J. C. Lane

Pacific Northwest Pipe Line

WORLD'S LONGEST PIPE LINE PROPOSED TO SERVE PACIFIC NORTHWEST. *Am. Gas J.* **173**, 13-14 (1950) *August*.

A 2,175-mile, 26-inch pipe line to transport natural gas from Wharton County, Texas, to the Seattle and Tacoma, Washington, and Portland, Oregon, areas has been proposed by Pacific Northwest Pipeline Corporation. Daily delivery capacity would be 250,000,000 cu ft, operating pressure would be 800 pounds per square inch and cost would be over $174,186,000. Two other companies, Northwest Natural Gas Co. and Westcoast Transmission Co., Ltd., have applications pending to serve the Pacific Northwest, both from gas supplies in Alberta, Canada. The Alberta government has held up approval to export natural gas until proof can be had that the Province's needs can be guaran-

teed for at least 50 years. Pacific Northwest Pipeline would also depend on some Canadian gas, 100,000,000 cu ft per day from the Alberta fields, but plans to supply an equivalent amount to the Vancouver, B.C., area.

J. C. Lane

Reserves

Johnson, K.W. EXPANDING MARKETS INCREASE VALUE OF NATURAL GAS RESERVES. *World Oil* 131, 63-64, 66, 68, 70 (1950) *August*.

The rapid expansion of natural gas pipe lines and the construction of numerous plants to recover natural gas liquids have made the discovery, production and reserves of natural gas of increased importance to the national economy and to the overall energy supply picture. Natural gas prices at the well should tend to increase as more pipe lines and gas processing plants seek contracts for the gas available. The recent veto of the Harris-Kerr bill which would have exempted independent producers and gatherers from Federal Power Commission control may have a depressing effect upon natural gas production and sale to pipe lines. Fear of regulation may prevent producers from selling gas for interstate transmission, the largest market, and thus strike a serious blow at the program of gas conservation which has developed during recent years as the importance of natural gas has become increasingly recognized.

J. C. Lane

Securities

Falvey, J. F. LOCAL OWNERSHIP OF PUBLIC UTILITIES SEEN ON THE UPSWING. *Am. Gas J.* 173, 28-29, 47-48 (1950) *August*.

A poll of utility executives showed them favoring local ownership of their stocks by a ratio of 15 to 1. Advantages cited included better stockholder-customer relations, improved public relations, better understanding of company problems, facilitation of proxy solicitations and strengthening of company prestige. The minority opinion held that broad diversified ownership is more important than local ownership. Arguments are given in some detail.

J. C. Lane

State Control

Smith, L. CAN SOUTHWESTERN STATES LIMIT GAS EXPORTATION? *Public Utilities Fortnightly* 46, 223-228 (1950) *August* 17.

Defeat of the Kerr Bill and the forthcoming hearings in the case of Phillips Petroleum Company create fear that the Federal Power Commission will attempt to impose control over independent producers and gatherers of natural gas. Gas-producing states may resist FPC assumption of control by taxation, limitation of production or even embargo on the export of gas. The courts may be called upon to interpret the legality of such acts. A need exists for cooperative thinkers and planners in both Federal and state governments to develop, by interstate compact or otherwise, a long-term policy in respect to the gas industry.

J. C. Lane

Synthetic Fuels

Farrar, L.D. ACRES OF PROMISE FOR SYNTHETIC FUELS. *Public Utilities Fortnightly* 46, 210-222 (1950) *August* 17.

The possibility that the United States may have to fuel a new major war has aroused increased interest in synthetic liquid fuels. Whether direct catalytic hydrogenation of coal (Bergius process) or the catalytic hydrogenation of carbon monoxide (Fischer-Tropsch process) is employed to synthesize these fuels, the production of gas from coal is an essential and costly preliminary step. Synthesis gas for the Fischer-Tropsch process must consist of carbon monoxide and hydrogen substantially free of contaminants or diluents. Producer gas, water gas or coke oven gas suitably purified are possible sources. Hydrogen may be obtained from these gases by reacting the carbon monoxide with steam and removing the resultant carbon dioxide. The cost of hydrogen constitutes about 50% of the total cost of liquid products from the Bergius process, while the cost of synthesis gas represents 60-70% of the total cost of Fischer-Tropsch products. The underground gasification of coal is being investigated as a lower cost method of producing gases suitable for both processes. Four methods, each suited best to a particular type of seam, have report-

edly been explored by the Russians in experiments beginning in 1930. The first American work was begun in 1946 at Gorgas, Alabama. Tests have indicated promise, but a number of technical difficulties remain. Some $750,000 has been expended by the Bureau of Mines to date, and the work is continuing.

J. C. Lane

3. COMBUSTION AND INDUSTRIAL FURNACES

Butane as Fuel

Joseph, J. LIQUEFIED PETROLEUM GAS VS REGULAR. *Construction Methods* 32, 62-64 (1950) *August*.

A construction company reports that after 15 years of experience with butane as a fuel for internal combustion engines in trucks and cranes they have shown a 25% reduction in maintenance cost and a 50% increase in engine life. Claims over a gasoline engine are: (1) greater power from butane and almost no lube oil dilution; (2) no carburetor troubles because it burns as a vapor instead of a gas; and (3) the system used for sealing units prevents "tinkeritis," thereby placing responsibility of all adjustments on one specialist. Conversion costs are placed at $150 to $170.

E. F. Davis

Furnace Design

Thring, M. W. HIGH-TEMPERATURE COMBUSTION-HEATED FURNACES. *J. Inst. Fuel* (Brit.) 23, 178-185 (1950) *July*.

The author discusses the main information which the furnace designer requires from the scientists in answer to the following questions: (1) How can the combustion volume or flame length be calculated and controlled to the desired value while excess air is minimized? (2) How can the flame emmissivity be calculated and given the highest possible value? (3) How can the flow pattern of the flame be arranged to bring it as near as possible to the charge, keep it away from refractories, and cover a large surface area of charge? It is stated that mixing of the gases in the combustion chamber is of primary importance to heat transfer and that in high temperature furnaces radiation contributes more heat to the charge than does convection.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Carbonization

Burns, J. THE EFFECT OF COAL QUALITY UPON THE RESULTS OF GAS MANUFACTURE AS EXPERIENCED BY THE NORTH THAMES GAS BOARD. *Gas World* (British) 132, 80-82 (1950) *July* 15.

Weighted averages of the analyses of coals received by the stations of the former Gas Light & Coke Company show that the Durham area coals in 1946-9 contained 2% more inerts than in 1938, and the Yorkshire-Midland area coals contained 3% more inerts. Actual carbonizing results, properly weighted, show a reduction in yield of gaseous therms of 3.45 and 3.90 for these respective coals. In addition to lowered coal quality, some of the reduction in war time must be blamed upon (1) deterioration in plant equipment with age, (2) changes in design of retort houses, (3) quality of labor and supervision, although these now approximate the conditions of 1938. The effects of the high inert content of coal is further aggravated by (1) longer storage and oxidation of coal, (2) decreased efficiency in retort heating because of high-ash producer fuel, and (3) increased amounts of dirty coal of lower gas yield. Deterioration in water gas yields of gaseous therms amounts to 10 therms/ton coke since 1938, with a corresponding coke-ash increase of 2.5%.

O. P. Brysch

Foxwell, G. E. and Johnson, C. A REVIEW OF SOME CARBONIZATION PROBLEMS, I. COAL REQUIREMENTS. *Gas Times* (British) 64, 45-46, 48, 53-54 (1950) *July* 14.

In 1949 the British gas industry carbonized 25.3 million long tons and the coke-oven industry carbonized 22.5 million tons out of a total of 175.7 million tons of available coal; thus 27.2% of the total available was carbonized. Progressive deterioration of coal purity has been recently accelerated by wider introduction of mechanical mining. Metallurgical coke from

impure coals has imposed severe losses in efficiency upon the iron and steel industry and the coal-cleaning plants must solve this problem by improved cleaning of the remaining supply of coking slacks. If clean, strongly coking coals are available both the metallurgical and gas industries can make greater use of the reserves of cheaper, lower-rank, weakly-caking coals in the form of blended charges. Retort plants, once built, require uniformity in the type of coal supplied, otherwise the whole gas plant economy is affected. Increased production of slack coals may be offset by future installation of coke ovens for base-load gas plant with reduced operating costs, which will ensure a future for existing vertical retort plants using coarser charges.

O. P. Brysch

Hemminger, C. E. (assigned to Standard Oil Development Co.) CARBONIZATION BY DIRECT HEATING IN A ROTARY RETORT. U.S. 2,511,709 (1950) June 13.

The invention comprises a rotary cylindrical retort wherein pulverized coking coal, pitch, asphalts, heavy residues are radiantly heated to 850 to 1400°F by a gas or oil burner inserted axially at one end of the drum. The heated coal or the liquid materials sprayed onto pulverized carbonaceous solids are tumbled by the rotation and agglomerate into balls. Gases and volatile products are withdrawn from the bottom of the tumbling pile by suction through baffle-protected pipes, while the combustion gases exit at about atmospheric pressures at the opposite end of the retort.

O. P. Brysch

Carbureted Water Gas

Charnley, F. S. REMOTE CONTROL AS APPLIED TO CARBURETED WATER GAS PRODUCTION. *Gas Times* (British) 63, 596, 599 (1950) *June* 23.

Automatic control of relief holder and auxiliary equipment located approximately ¼ mile from the generating works of a carbureted water gas plant incorporates several regulating devices such as (1) exhauster motor speed controller to maintain correct relief holder height, (2) pressure switch to cut out the exhauster to prevent grounding of holder and prevent air reaching the tar scrubber, and (3) sequence interlock to prevent the revivification air blowers from operating unless the exhausters are running. Other control instruments and alarms for this plant are described.

C. Von Fredersdorff

Coal Composition

Shotts, R.Q. AN OXIDATION METHOD FOR INVESTIGATING THE PETROGRAPHIC COMPOSITION OF SOME COALS. *Mining Eng.* 187, 889-897 (1950) *August.*

Rates of oxidation of petrographic constituents of four Alabama coals by the nitric acid method are reported. Studies of fractions of different sizes and densities have shown significant differences in the rates of oxidation of the nonfusain constituents, those of lower density (brighter components) being more rapidly oxidized. Since high fusain content distorts the fixed carbon value and thus raises the "rank" of the associated coal constituents, the nitric acid oxidation rate also might prove more suitable as an index of rank than the fixed carbon content. However, the effects of rank and those of the bright and dull constituents upon the rate tend to obscure each other and considerably more study and correlation is needed.

O. P. Brysch

Coal Desulfurization

Ghosh, J. K. and Brewer, R. E. DESULFURIZATION OF COAL DURING CARBONIZATION. *Ind. Eng. Chem.* 42, 1550-1558 (1950) *August.*

Desulfurization experiments were continued [see *Gas Abstracts* 5, 238 (1949) *October*] using a coal from Ledo Colliery, Assam, India. This coal is low in ash, has good coking properties, but contains up to 7.5% sulfur, mostly in the organic form. Carbonization with added lime or sodium carbonate produced a coke whose sulfur content could be reduced to as low as 2.1% by leaching. Ammonia gas added during carbonization reduced the coke sulfur to as low as 2.9%. The desulfurizing effect of ammonia was increased by the addition of aluminum oxide to the coal, the coke sulfur dropping

to a minimum of 1.6%. Sulfur compounds were determined in the gaseous, liquid, and solid carbonization products. Comparative tests were run on a high-sulfur Illinois No. 6 bed coal.

W. E. Ball

Coal Oxidation

Yohe, G. R. COAL OXIDATION: ACTIVE OXYGEN AND RUSSELL EFFECT. *Fuel* (British) 29, 163-165 (1950) *July*.

Coal and other materials which produce an image when placed in contact with a photographic plate in the dark (Russell effect) also show an oxidizing action. This action has been shown to be due to organic peroxides, formed in the initial stages of oxidation of these substances in air, 60 to 160 x 10-5 grams of peroxygen per gram of coal having been found as a maximum. Fusain has been reported most active in this report, but reported activities for clarain, vitrain and durain are not in agreement as to order and amount.

O. P. Brysch

Coke Ovens

Wilputte, L. (assigned to Allied Chemical & Dye Corp.) UNDERFIRED REGENERATIVE COKE-OVEN BATTERY. U. S. 2,515,814 (1950) July 18.

Ventilation is provided for the basement of an underfired regenerative coke oven battery by admitting air through high and low louvres along one side of the battery, and drawing it off on the other side through a chimney flue communicating with the regenerators. The admission of air may be controlled by the louvres to provide moderate temperature in the basement.

W. E. Ball

Wilputte, L. (assigned to Allied Chemical & Dye Corp.) UNDERFIRED REGENERATIVE COKE-OVEN BATTERY. U. S. 2,515,815 (1950) July 18.

In a refinement of U.S. 2,515,814, the air to the basement is supplied under positive pressure from an air duct communicating with the atmosphere at one or both ends of the battery. This allows more air to be supplied to the basement, and insures an air supply with a minimum of coal and coke dust.

W. E. Ball

Coking

Perch, M. (assigned to Koppers Co., Inc.) COKING EXPANDING COALS. U. S. 2,504,150 (1950) April 18.

The inventor, to counteract excessive expansion pressures produced in slot-type coke-ovens by certain coals, proposes the addition of 7.5 to 10% of pitch to the coal charge together with the superposition of a layer of coke breeze or other gas-permeable non-coking material upon the top of the charge.

O. P. Brysch

Effluent Treatment

Badger, E. H. M. A SURVEY OF THE LIQUOR DISPOSAL PROBLEM. Inst. Gas Engrs. Communication 360. (1950) *February*.

Consideration of the nature of pollution, methods of reduction of polluting matter and disposal of liquor leads to the conclusion that the most satisfactory method of disposal for gas works is a controlled discharge to the sewer. The waste liquor should contain the minimum quantities of thiocyanate and polyhydric alcohols, with free ammonia, sulfide, and cyanide removed by distillation. Dephenolation should be carried out if the waste liquor cannot be sufficiently diluted, or if discharge is to a waterway.

W. E. Ball

Wedgwood, P. TREATMENT OF EFFLUENTS FROM C.W.G. PLANTS. *Gas World* (British) 132, 24-25 (1950) *July* 1.

The treatment recommended for surplus liquor from carbureted water gas plants consists of decantation in a 60° cone, surmounted by a cylindrical section. The liquor enters near the bottom, the upward velocity not exceeding 14 gal per sq ft per hr at the top. The floating oils are removed by passing the decanted liquor through a filter tank containing a layer of coke breeze on a 6 in layer of gravel, at a rate not exceeding 7 gal per sq ft per hr. Water softener sludge is added to the cone to assist in breaking the emulsion.

W. E. Ball

Electro-Detarring

Francombe, K. W. ELECTRO-DETARRING. Inst. Gas Engrs. Communication 358 (1950) February.

Although the first electro-detarrer in Great Britain was installed only 22 years ago, there are now about 600 installations in that country. This paper provides a review of the growth and the present state of the art, together with a note of the current developments. Included are sections on basic principles, basis of design, characteristics, features of commercial installations, applications, resultant benefits, and developments and research. The electro-detarrer is designed to remove usually 99% of the tar fog at low capital and operating costs.

W. E. Ball

Gas Fractionation

Haynes, P. E. (assigned to Koppers Co., Inc.) SEPARATING CONSTITUENTS OF COKE OVEN GASES. U. S. 2,503,265 (1950) April 11.

For the recovery of olefines from coke oven gas, the gas is compressed to a pressure of 12 to 25 atm, partially liquefied, and the low boiling constituents separated as a single fraction. The latter mixed gas plus methane is expanded in an expansion engine to provide cooling for demethanization of the liquid products and to provide work for compression of the gas. Ethylene and propylene are recovered from the demethanized liquid products by rectification.

W. E. Ball

Light Oil Recovery

Hoffert, W. H. and Claxton, G. THE RECOVERY OF BENZOLE AT GAS WORKS AND AT COKE OVENS. *Gas World* (British) 132, 100-107 (1950) *July* 22.

This general review of light oil recovery and refining was presented at the Fourth World Power Conference. Subjects discussed include theory of oil washing, sludging of wash oil, oil washing under pressure, active carbon recovery, recovery by cooling, sulfur removal, sulfuric acid treatment, the corrosion problem, and hydrogenation refining. 36 references are given.

W. E. Ball

Purification

Hopton, G. U. and Hubbard, W. S. GAS PURIFICATION. *Gas World* (British) 132, 82-84 (1950) *July* 15.

Multi-tube vertical water-tube condensers, with cooling towers are mentioned as the modern trend in cooling at high rates of flow. Primary condensers and washer coolers are advantageous for naphthalene removal and cooling. Multistage static oil washers with restricted benzole recovery before the ammonia washers has relieved sludge troubles. Electrostatic precipitators have set high standards of tar removal, and single units should be located at lowest gas temperatures just before the purifiers. Modern efficient ammonia washers are desirable to produce liquor of the maximum NH_3 content. Careful control of oxygen absorption and suspended solids in the effluent liquor are needed, whether or not the liquor is treated at the works or handled by sewage systems. Recent discoveries in the mechanism of iron-oxide removal of H_2S have indicated the possible procedures for addition of moisture and air to prevent caking of oxide. High labor and capital costs are forcing the adoption of new methods of gas purification such as the Bournemouth oxide-tower method, and the Manchester or Koppers liquid purification processes. Processes for removal of organic sulfur, especially thiophene and carbon oxysulfide, are of great importance.

O. P. Brysch

Walker, R., Wilkin, C. R., Cooper, H. G. and Thompson, J. REMOVAL OF HYDROGEN SULFIDE FROM GASES. U. S. 2,503,528 (1950) April 11.

A method for removing H_2S from manufactured, natural, or effluent gases by washing at 20 to 30° C in a series of three or more scrubbers using an aqueous alkaline suspension containing a soluble carbonate salt and a suspended iron compound such as hydrated iron oxide, iron carbonate, or basic carbonate of iron is claimed. Spent liquor is revivified by oxidation

with air. Each washing treatment is operated to effect 70-95% removal of the H_2S present in the gas prior to that washing. As an example results are given for H_2S removal from coal gas employing 5 washing towers having a total height of packing of 30 ft and circulating 1750 gals of liquor per hr to treat 30,000 cu ft of gas per hr. The mean velocity through the packing was 2 ft sec, the contact time per washing operation was $3\frac{1}{4}$ sec, and the concentration of alkali was 0.75% ammonia present as carbonate and bicarbonate. H_2S content of the foul gas at the inlet was 505 gr/100 cu ft, which was reduced to 75 gr/100 cu ft in Tower 1, 10 gr/100 cu ft in Tower 2, trace (about 1.4 gr/100 cu ft) in Tower 3, clean (about 0.2 gr/100 cu ft) in Tower 4, and 0.03 gr/100 cu ft in Tower 5.

H. Hakewill

Underground Gasification

Fies, M. H. and Elder, J. L. EXPERIMENTS IN UNDERGROUND GASIFICATION OF COAL CONTINUE AT GORGAS. *Am. Gas J.* 173, 15-18 (1950) *July.*

Preliminary results of the second experiment on underground coal gasification with air are reported. The experiment is conducted in the Pratt coal bed area near Gorgas, Alabama, utilizing an isolated coal seam some 42 in. thick lying under an average overburden of 150 ft. The system consists of a 1540 ft. straight line passage in the coal, connected to five surface boreholes spaced from 200 to 300 feet apart. The objective of the work is (a) to determine the quantity of coal that can be gasified from a given initial combustion zone; (b) to test the design and installation of types of fixed product-gas outlets, including seals required; (c) to determine the optimum length of coal passage, the quantity and quality of products evolved and action of heat on overlying strata; and (d) to develop economic information. Thus far, some 5100 tons of coal were gasified between the first two boreholes. Difficulties from the by-passing of air around the combustion zone resulting in a diluted product gas were partially overcome by the injection of fluidized sand in the underground crevices. Analysis shows that approximately a 100 Btu gas was generated at the burning coal ribs, which, after combustion with by-passed air, was reduced to a 30 Btu gas at the outlet. Experiments are continuing to improve gas quality. A bibliography is included.

C. Von Fredersdorff

UNDERGROUND GASIFICATION OF COAL. *Gas Times* (British) 63, 463-464, 467 (1950) *June* 16.

Gasification of coal underground is progressing at Sheffield, England in the first experiments with 4 in. boreholes spaced 50 ft apart. Experience in drilling and ignition are reported but no technical data are included.

C. Von Fredersdorff

Vertical Retorts

Duxbury, A. D. THE DRYING-OUT AND LIGHTING-UP OF VERTICAL RETORT INSTALLATIONS. *Gas World* (British) 132, 153-157 (1950) *August* 5.

The changes in the crystalline forms of silica at temperatures below 600°C are reviewed. The various stages of the drying out and heating up of rebuilt or repaired vertical retort settings are discussed in considerable detail, with careful instructions for the operator.

O. P. Brysch

Water-Gas Shift Reaction

Atwood, K., Arnold, M. R. and Appel, E. G. WATER-GAS SHIFT REACTION. *Ind Eng. Chem.* 42, 1600-1602 (1950) *August.*

Laboratory studies of the influence of pressure in the range of 1 to 30 atmospheres on the rate of the water-gas shift reaction were made at temperatures of 655°F and 760°F. The activity of commercial iron oxide-chromium oxide catalyst approximately doubled as the pressure was raised from atmospheric to 10 atmospheres and increased only slightly as the pressure was further increased. Plots of catalyst activity against pressure at the two temperatures gave curves similar in shape to Langmuir isotherms.

C. H. Riesz

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Eberhart, F. KNOXVILLE PREPARES FOR CONVERSION TO NATURAL GAS. p. 168

Fritz, C. L. GAS DISTRIBUTION SYSTEMS FACE OVERLOAD IN CHANGEOVER PERIOD. p. 168

Glenn, R. A., Basu, A. N., Wolfarth, J. S. and Katz, M. COAL HYDROGENATION PROCESS STUDIES. p. 174

Mott, R. A. RAPID DETERMINATION OF PYRITIC AND SULFATE SULFUR IN COAL. p. 176

Shepherd, M. ANALYSIS OF A CARBURETED WATER GAS BY VOLUMETERIC CHEMICAL METHODS AND BY MASS SPECTROMETER. p. 177

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Changeover

Eberhart, F. KNOXVILLE PREPARES FOR CONVERSION TO NATURAL GAS. *Gas Age* **106**, 26-27, 66, 68, 70 (1950) *July* 20.

East Tennessee Natural Gas Corporation has recently completed the southern unit of their loop shaped system. The northern unit was completed last January to Oak Ridge. A map of the transmission system is included. Knoxville and Chattanooga will shortly be served by natural gas and appliance conversion is underway. A brief description is given of the preparations and plans for converting Knoxville to natural gas. Complete conversion of any one section will take three days. However, all gas refrigerators will be converted in the first two hours. Water heaters, ranges, and finally space heating appliances will be converted in that order. Only the ranges will be left in continuous service during the conversion period.

O. T. Bloomer

Fritz, C. L. GAS DISTRIBUTION SYSTEMS FACE OVERLOAD IN CHANGEOVER PERIOD. *Am. Gas J.* **173**, 19-22, 44-45 (1950) *July*.

Problems encountered in the distribution system of the Philadelphia Electric Company because of increased house heating load are discussed. From 1945 to the end of 1949 the house heating load increased over 300%. The article is devoted almost entirely to the dust problem created by higher gas velocities and the dryness of the gas now being distributed. "Carboseal" has been introduced extensively into the high pressure mains, where gas velocities are highest, in order to settle the dust. Gas scrubbers have also been used. An accurate record of customer complaints, blowing seal, dust stoppage, etc., has been kept and spotted on large scale maps. These records have been invaluable in deciding which mains should be replaced and when and how the dust problem should be attacked.

O. T. Bloomer

Compressor

Sheker, E. B. DAMPERS SOLVE GAS COOLING PROBLEM. *Gas Age* **106**, 29, 67 (1950) *August* 17.

Hot gas used for regeneration of granular dehydration agent is cooled by an air stream. In warm weather the air is forced through a venturi type cooler by fans, the speed of the fans being controlled in proportion to the air velocity required. In cold weather natural air circulation is adequate, but in very cold weather even this is too much as hydrates may form. A system of dampers was installed in order to prevent undue gas cooling.

J. D. Parent

LP Gas Unit

Thompson, H. F. NEW LPG UNIT TAKES CHARGE FROM POLYMER DE-PROPANIZER. *Petroleum Processing* **5**, 841 (1950) *August*.

Sinclair Refining Company has placed a new unit on stream which is capable of producing 1100 bbl per day of LPG. The product meets NGAA requirements and is composed of 0.5%

ethane and 4.0% propylene and 95.5% propane. Butanes and lighter components from cracked distillate stabilization are treated with diethanolamine for sweetening, subjected to high pressure polymerization in which 85 to 90% of the propylene-butylene content is reacted, deethanized in a 20 plate fractionator and dried with bauxite. The operation was undertaken to meet the ever-increasing demand for LPG in the North Atlantic seaboard area where freight charges on Mid-Continent LPG are very high.

J. D. Parent

Thompson, H. F. REFINERY LPG UNIT EMPLOYS STEAM JET VACUUM REFRIGERATION. *Petroleum Refiner* **29**, 105-106 (1950) *August*.

One of the interesting features of this refinery LPG unit is the application of steam jet vacuum refrigeration. While refrigeration in the recovery and fractionation of light hydrocarbons is employed in many plants, the use of steam jet refrigeration is unusual. Critical evaluation of economic and operating factors indicated that the selection of this refrigeration system would be justified here.

Author's abstract

Odorization

Johnson, E. E. NEW DEVELOPMENTS IN ODORANTS. Paper presented at the American Gas Association Production and Chemical Conference at New York, N.Y., May 22-24, 1950.

The requirements of an ideal gas odorant are listed and discussed from the standpoint of utilization under practical conditions. The problems encountered in the development of a new odorant to meet the specifications set forth are indicated with emphasis on odorant evaluation and economic feasibility of production.

H. Hakewill

Senatoroff, N. K. ODORIZATION PRACTICES. Paper presented at the American Gas Association Production and Chemical Conference at New York, N.Y., May 22-24, 1950.

The development of materials for odorizing natural gas and the techniques employed for odor addition are reviewed. Schematic diagrams are provided to illustrate ten of the more common types odorizing units in service. A table summarizing the physical properties of ten odorants in general use is presented.

H. Hakewill

Pipe Lines

Johnson, W. SPOT RECONDITIONING ON PIPE LINE IN PLACE, WHILE IN SERVICE. *Oil Gas J.* **49**, 61-62, 64 (1950) *August* 10.

The program followed by Standard Pacific Gas Line, Inc. for spot reconditioning a 56 mile pipe line is described. The distribution of personnel and equipment required and the itemized cost figures for this program are given.

B. E. Hunt

LaRock, T. B. LOWERING-IN PROCEDURE INCORPORATING THE SLACK LOOP PRACTICE AS USED BY EL PASO NATURAL ON CONSTRUCTION OF 30-IN. TRANSMISSION LINE. *Oil Gas J.* **49**, 99-101 (1950) *July* 13.

The standard practice of El Paso Natural Gas Company is to use a slack loop in every 1000 ft of straight pipe. This technique is used because of ground temperature variation at pipe level of 40°F, which could introduce serious stresses in the pipe. The slack produced by lifting a section of 30 in. pipe five feet is approximately 2 inches. When backfilled this places the line under compression. The construction procedure used is described in detail.

O. T. Bloomer

McCormack, J. E. NEW YORK BUILDS OWN NATURAL GAS LINE. *Gas Age* **106**, 19-22, 64-66 (1950) *July* 20.

Feature and construction methods used by Consolidated Edison Company in installing 25 miles of large diameter high pressure gas main through a highly congested area are discussed. This line connects with the Transcontinental Gas Pipe Line at the Hudson River. Pipe specifications and thickness, welders qualification tests, inspection testing, pipe insulation and cathodic protection are the principal topics of the article.

O. T. Bloomer

Moore, W. B. ALUMINUM GAS PIPE. *Gas* **26**, 88 (1950) *July*.

10-$\frac{3}{4}$ in. O.D., $\frac{3}{16}$ in. thick aluminum pipe was used recently in a river crossing near Bowie, Oklahoma. The pipe carries sweet gas under 250 psi pressure. The pipe was supported from a single steel cable with a span of 318 ft pier to pier. A considerable saving in cost is claimed because of the simpler suspension possible.

O. T. Bloomer

Titus, E. TRANSCONTINENTAL CROSSES 40 RIVERS. *Gas* **26**, 90-92 (1950) *July*.

Forty major river crossings are to be made by Transcontinental Gas Pipe Line Corporation in their Texas to New York Line. Included is the longest pipeline suspension bridge so far attempted and a submarine crossing of the Hudson River. Considerable construction and engineering details of these and other crossings are presented in the article.

O. T. Bloomer

Production

Campbell, J. A. WHAT I LEARNED FROM A MODEL. *Petroleum Engr.* **22C**, 19,20,22,24 (1950) *July*.

The writer champions the cause of a modified perforated plate to be used in absorbers and similar columns. Experiments in glass and lucite models are described and illustrated.

J. D. Parent

de Witte, L. RELATIONS BETWEEN RESISTIVITIES AND FLUID CONTENTS OF POROUS ROCKS. *Oil Gas J.* **49**, 120-122, 124, 126, 128-132 (1950) *August* 24.

It has been shown by Patnode and Wyllie that Archie's resistivity formulae for porous rocks apply only if the rock substance is non-conductive. The author of this paper has developed a novel means of accounting for the rock effect, and has worked out formulae on this basis. Conductive solids are conceived of as being in suspension in interstitial water.

J. D. Parent

Fletcher, C. D. GAS LIFT PRINCIPLES AND PRACTICE. PART I. *World Oil* **131**, 157-158, 162-165 (1950) *July* 1.

This is the first of a four part series on gas lift principles and practices. Part I treats briefly on the determination of well conditions, production history, factors in selecting the gas supply, and the principles of operation of the two types of gas lift. The two types are: (1) intermitting flow (flow by slug lifting) and (2) automatic differential and continuous flow (flow by "aeration"). The principle of operation of the intermitting flow type is discussed in detail in this section.

O. T. Bloomer

Latchum, J. W., Jr. (assigned to Phillips Petroleum Co.) RECOVERY OF HYDROCARBONS FROM NATURAL GAS. U.S. 2,504,429 (1950) April 18.

Certain modifications in the usual high pressure oil absorption procedure for recovery of liquefiable hydrocarbons from natural gas whereby it is claimed that power requirements are lessened and equipment size is decreased. Secondary vent tank vapors and still overhead vapors are not to be mixed, but are to be treated separately.

J. D. Parent

Penrod, J. M. JOE'S LAKE FIELD PIONEERS SECONDARY-RECOVERY METHODS IN EOCENE WILCOX SANDS. *Oil Gas J.* **49**, 239-243 (1950) *June* 22.

Joe's Lake field in Tyler County, Texas, producing from the Eocene Wilcox sand, has been subjected to pressure maintenance by gas injection and at the present time is under a program of water injection. The producing history, water supply and injection system are briefly discussed.

O. T. Brysch

Perkin, J. A., Jr. COMPLETION AND PRODUCTION TECHNIQUES IN UNCONSOLIDATED SANDS. *Oil Gas J.* **49**, 113-114, 116, 119 (1950) *August* 24.

The problem of casing a well in unconsolidated sands is discussed and several methods presented.

J. D. Parent

Wright, F. D. and Ballinger, H. J. DEVELOPMENT OF A MOBILE COMPRESSOR AND UTILITY STATION. U. S. Bureau of Mines Report of Investigations 4709 (1950) July.

The design and operation of a mobile compressor station at the Bureau of Mines oil shale project in Colorado are described. Additional compressed air was necessary to supply an experimental rig holding four pneumatic rock drills, and the mobile station was designed to meet this need. The unit consists of two 770 ft^3/min air compressors, a 200 ft^3 receiver, and a 2,500 gal water tank for the drills. It is mounted on a 30 ton, drop-frame trailer 30 ft long by 12 ft wide. The air and H_2O tank operate at 150 psig. The following advantages are claimed: (1) an adequate air supply at constant pressure; (2) cost of installation and removal of air and water lines is eliminated; (3) friction and leak losses are minimized; (4) the effective capacity of the compressors is increased about 12% because the air is used before all of its heat energy is dissipated.

W. G. Bair

Purification

Kohl, A. L. and Blohm, C. L. TECHNICAL ASPECTS OF GLYCOL-AMINE GAS TREATING. *Petroleum Engr.* **22C**, 37-38, 40-42, 44 (1950) *June.*

A summary of the results of plant tests on the glycol-amine treating plants of the El Paso Natural Gas Company are presented. These plants are used for the simultaneous removal of hydrogen sulfide and water vapor from gas. A table of operating data on the contactors and stills is included.

O. T. Bloomer

Rahmes, M. H. SOUR GAS: NEW PLANT OPERATING MEA, DEHYDRATION, CAUSTIC, AND COPPER CHLORIDE UNITS. *Petroleum Refiner* **29**, 118-122 (1950) *August.*

Flow sheets are presented for a plant handling 50 MMcf of sour gas daily. Gas is used for repressuring. Gas and liquid condensed by compression are sweetened with monoethanolamine. Mercaptans are removed from depropanizer bottoms by caustic while propane is treated with caustic and then dehydrated. Gasoline is treated with copper chloride.

J. D. Parent

Storage

Kubista, W. R. UNDERGROUND STORAGE OF NATURAL GAS. *World Oil* **131**, 212, 214, 216 (1950) *August.*

Factors which influence the acquisition of underground storage facilities together with the problems which must be solved before such storage can become effective, are discussed in this article. Precautions to be observed in plugging or reworking old wells are outlined as is a method for predicting deliverability of stored gas. This paper was presented before the 1950 Short Course in Gas Technology, Texas College of Arts and Industries, Kingsville, Texas.

Author's abstract

Transmission

Kraus, A. F. MEASUREMENT AND CONTROL OF HIGH PRESSURE GAS. *World Oil* **131**, 205-206, 208 (1950) *August.*

Precautions required for proper measurement of flow rate are described. Problems discussed include pressure regulation, pulsation and hydrate formation.

J. D. Parent

McDonald, P. W. and Woods, E. M. OIL CONTACT SCRUBBERS. *Gas* **26**, 43-44, 47 (1950) *August.*

Horizontal scrubbers used on the Texas to California line are described. Capacity tests are reported.

J. D. Parent

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

Scott, G. N. SOME CHARACTERISTICS OF MASTIC-TYPE PIPE COATINGS. p.

Shepherd, M. ANALYSIS OF NATURAL GAS: COMPARISON OF TWO CHEMICAL METHODS. p. 176

Walker, R., Wilkin, C. R., Cooper, H. G. and Thompson, J. REMOVAL OF HYDROGEN SULFIDE FROM GASES. p. 166

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Fischer-Tropsch Synthesis

Anderson, R. B., Schultz, J. F., Seligman, B., Hall, W. K. and Storch, H. H. STUDIES OF THE FISCHER-TROPSCH SYNTHESIS. VII. NITRIDES OF IRON AS CATALYSTS. *J. Am. Chem. Soc.* 72, 3502-3508 (1950) *August.*

After converting the iron in a reduced synthetic-ammonia catalyst to nitrides by ammonia treatment, greatly increased activity for Fischer-Tropsch synthesis was observed. X-ray examination indicated that catalysts containing ϵ-phase nitrides yielded a product of lower average molecular weight and gave greater yields of gaseous hydrocarbons and oxygenated compounds than was found among the products obtained from the corresponding reduced iron catalysts. The nitrided catalysts appear to resist oxidation and deposition of free carbon and possess high stability and long life.

C. H. Riesz

Clarks, A. (assigned to Phillips Petroleum Co.) PRODUCTION OF DIOLEFINS AND MOTOR FUEL FROM CARBON MONOXIDE AND HYDROGEN. U.S. 2,506,065 (1950) May 2.

A process is claimed which utilizes a water-soluble fraction of the oxygenated hydrocarbons formed in Fischer-Tropsch synthesis. This fraction, boiling below 212 F and containing principally ethyl alcohol, is converted to butadiene over suitable catalysts under specified processing conditions.

C. H. Riesz

Hofer, L. J. E. and Cohn, E. M. THERMOMAGNETIC DETERMINATION OF HÄGG CARBIDE IN USED IRON FISCHER-TROPSCH CATALYSTS. *Anal. Chem.* 22, 907-910 (1950) *July.*

A magnetic balance has been used for the qualitative and quantitative determination of the ferromagnetic phases present in used Fischer-Tropsch iron catalysts. Used in conjunction with x-ray and chemical analyses, thermomagnetic curves for the three-component system Fe_2C-Fe_3O_4-alpha-Fe are interpreted. The magnetically nondetectable iron may be related to the catalytic activity.

C. H. Riesz

Keith, P. C. (assigned to Hydrocarbon Research Inc.) CATALYTIC SYNTHESIS OF HYDROCARBONS. U.S. 2,506,221 (1950) May 2.

A fluidized bed reactor is described and claimed which converts carbon monoxide and hydrogen into hydrocarbons in a plurality of vertically spaced reaction zones. Provision is made to add reacting gases to each zone along with the effluent from the next lower zone.

C. H. Riesz

Krebs, R. W. (assigned to Standard Oil Development Co.) METHOD FOR REGENERATION OF A HYDROCARBON SYNTHESIS CATALYST. U.S. 2,506,302 (1950) May 2.

In the synthesis of hydrocarbons from carbon monoxide and hydrogen, carbon deposited on the iron catalyst is removed by contact with iron oxide at temperatures of 1200-1400 F.

C. H. Riesz

Layng, E. T. (assigned to Hydrocarbon Research Inc.) STAINLESS STEEL CATALYST FOR HYDROCARBON SYNTHESIS. U.S. 2,506,226 (1950) May 2.

Finely divided stainless steels have been found suitable as catalysts for the synthesis of hydrocarbons from carbon monoxide and hydrogen.

C. H. Riesz

Mattox, W. J. (assigned to Standard Oil Development Co.) PROCESS OF REGENERATING A FLUIDIZED FISCHER-TROPSCH CATALYST. U.S. 2,515,245 (1950) July 18.

Iron catalysts carbonized by use in the synthesis of hydrocarbons from carbon monoxide and hydrogen are regenerated in two stages. In the first stage, relatively mild oxidation conditions are used consisting of temperatures of about 500°-1100° F and an oxidizing atmosphere conducive to the oxidation of the iron component in preference to the combustion of carbon. This mild oxidation procedure is further defined in that if carbon dioxide is used as the oxidation agent, the partial pressure ratio of $CO:CO_2$ lies between 0.01 and 0.6; if steam is used, the partial pressure ratio of $H_2:H_2O$ falls between 1.0 and 27; and if mixtures of steam and carbon dioxide are used, the partial pressures of the individual constituents should be kept within these ranges. The second stage of the oxidation procedure is relatively severe and temperatures of 700-1400° F are used.

C. H. Riesz

Mosesman, M. A. (assigned to Standard Oil Development Co.) METHOD FOR PREPARING A FISCHER TROPSCH CATALYST. U.S. 2,503,963 (1950) April 11.

Catalyst for the Fischer-Tropsch synthesis is prepared by igniting a mixture of approximately two parts of finely divided iron with three parts of alkali metal nitrate. To form the finished catalyst, the ignited mixture is oxidized at approximately 1000° F for 4 hours and then reduced at approximately 700° F and 24 hours. The alkali metal nitrate may be potassium nitrate, sodium nitrate or lithium nitrate.

C. H. Riesz

Rupp, W. H. (assigned to Standard Oil Development Co.) PRODUCTION OF GASES RICH IN HYDROGEN. U.S. 2,514,340 (1950) July 4.

A minor portion (10-30%) of the tail gas from Fischer-Tropsch synthesis is scrubbed with lean oil at the rate of 40 to 200 gallons per Mcf. This removes a large part of the carbon dioxide and produces a hydrogen-rich gas. The remainder of the tail gas (90-70%) is scrubbed with the oil used alone to recover C_3—and higher hydrocarbons.

C. H. Riesz

Sensel, E. E., Millendorf, A. J. and Beck, R. A. (assigned to Texas Co.) METHOD FOR SYNTHESIZING HYDROCARBONS AND THE LIKE. U.S. 2,503,356 (1950) April 11.

In the synthesis of hydrocarbons from carbon monoxide and hydrogen, the synthesis gas is passed first over a cobalt-thoria catalyst at about 390° F and then over a cobalt-thoria catalyst alkalized with about 5.5% sodium carbonate at about 430° F. The contact time in the first stage can be adjusted so that the heat liberated is sufficient to increase the temperature of the stream to that required by the alkalized catalyst.

C. H. Riesz

Hydrocarbon Synthesis

Buchmann, F. J. (assigned to Standard Oil Development Co.) SYNTHESIS CATALYST. U.S. 2,512,608 (1950) June 27.

For use as a catalyst for hydrocarbon synthesis, molten iron containing promoter is sprayed in a reducing atmosphere onto spherical particles of aluminum.

C. H. Riesz

Grahame, J. H. (assigned to Texaco Development Corp.) SYNTHESIS OF HYDROCARBONS. U.S. 2,503,724 (1950) April 11.

The combustion of an isosynthesis process with a previously disclosed synthesis process is claimed. The previously disclosed synthesis process includes an improvement whereby excess carbon dioxide is added to the synthesis gas.

C. H. Riesz

Hirst, L. L. and Chafee, C. C. LIQUID FUEL FROM COAL. *Ind. Eng. Chem.* 42, 1607 (1950) *August*.

The Bureau of Mines hydrogenation demonstration plant at Louisiana, Mo., has now made five hydrogenation runs during the first year of operations. The difficulties and accomplishments are stated briefly.

C. H. Riesz

ISOSYNTHESIS PROCESS *Oil Gas J.* **49**, 92, 95, 107-108 (1950) *August* 17.

This article is a summary of a paper by H. Pichler and K. H. Ziesecke, "High-Pressure Hydrogenation of Carbon Monoxide to Predominantly Isoparaffinic Hydrocarbons (Isosynthesis)," which appeared in *Brennstoff-Chemie*, January 13, 1949, pp. 13-21. The tests leading to the selection of temperature, pressure, and catalysts for isosynthesis are described.

C. H. Riesz

Abstractor's Note: The complete paper has been issued as U.S. Bureau of Mines Bulletin 488 (cf *Gas Abstracts* **6**, 134 (1950) *July*.)

Hydrogenation

Glenn, R. A., Basu, A. N., Wolfarth, J. S. and Katz, M. COAL HYDROGENATION PROCESS STUDIES. I. ON THE ROLE OF COAL SULFUR IN THE HYDROGENATION OF COAL. *Fuel* (British) **29**, 149-159 (1950) *July*.

Three coal samples selected from a single mine of Pittsburgh seam coal ranging in sulfur content from 0.83 to 4.37% were subjected to restricted hydrogenolysis with Adkins copper-chromite catalyst at 662° F and 707° F. The products recovered in a cold-head receiver were analyzed extensively. For the hydrogenation at 662° F but not at 707° F, it was possible to make several correlations of product yields with the sulfur content. The role of the original coal sulfur in the hydrogenation of coal is indicated to be complex.

C. H. Riesz

Falkum, E. and Glenn, R. A. COAL HYDROGENATION PROCESS STUDIES. II-EFFECTS OF TEMPERATURE ON THE RESTRICTED HYDROGENOLYSIS OF A SPITSBERGEN COAL WITH ADKINS CATALYST. *Fuel* (British) **29**, 178-184 (1950) *August*.

The effect of temperature on the hydrogenation of a Spitsbergen coal was studied over the range at 527° F to 730° F. This coal from the west coast of Spitsbergen, Norway, was classified as a high volatile A bituminous coal. An extensive analysis of the products was made, maximum yield of distillate oil being recovered at 707° F.

C. H. Riesz

Sherwood, P. W. HIGH-PRESSURE HYDROGENATION OF CARBONACEOUS MATTER. PART VIII. THE INTEGRATED PROCESS. *Petroleum Refiner*. **29**, 107-110 (1950) *August*.

This is the eighth and final article of a series on high pressure hydrogenation of carbonaceous matter. Process requirements for hydrogenating various raw materials are summarized. The process is inefficient thermally—only 30 to 50% of the heat being recovered in usable form, the main loss being in the production of purified, high-pressure hydrogen. Production costs based on German figures and American estimates are presented. The potentialities of high pressure hydrogenation are such that research to improve and develop the process is justified.

C. H. Riesz

Methane Reactions

Sherwood, P. W. HIGH TEMPERATURE REACTIONS OF METHANE. *Petroleum Engr.* **22C**, 14, 16, 18 (1950) *July*.

Several high temperature reactions of methane are reviewed. These include production of carbon black, generation of synthesis gas and hydrogen, production of hydrocyanic acid, acetylene formation and conversion into aromatic liquid hydrocarbons.

C. H. Riesz

Production

Burdine, N. T., Gournay, L. S. and Reichertz, P. P. PORE SIZE ISTRIBUTION OF PETROLEUM RESERVOIR ROCKS. T. P. 2893. *Trans. AIME* **189**, 195-204, *J. Petroleum Technol.* **2** (1950) *July*.

An investigation of equivalent pore entry radii in typical samples of petroleum reservoir rock and the pore volume associated with each value of pore entry radius has been made. Theoretical discussions together with experimental procedures for obtaining pore entry radii and the distribution of pore volume with pore entry radii are presented. Experimental results on a number of core samples, along with typical distribution curves, are shown. Data on the per cent of the pore volume filled by mercury at a

pressure of 1500 psi are included. The results of re-runs of samples, made possible by regenerative apparatus, show the repeatability of the data and indicate the amount of physical change in the samples by mercury penetration. Theoretical equations for calculating permeability from pore size distribution data were derived and the results of such calculations are compared with measured gas permeability data. The effect of the shape, surface area, and weight of the sample on the pore size distribution of reservoir rocks was investigated experimentally. Mercury capillary pressure curves are compared with those obtained by the porous diaphragm method using gas to displace water.

Authors' abstract

Dyer, H. J. GAS AND LIQUID SEPARATOR. U.S. 2,515,202 (1950) *July* 18.

A horizontal well-head separator for oil wells is described. The general object of the invention is to provide a single device for separation of gas and oil which will permit metering of the oil at separator conditions.

J. D. Parent

Synthesis Gas

Davidson, D. D. (assigned to Shell Development Co.) PRODUCTION OF SYNTHESIS GAS. U.S. 2,513,994 (1950) July 4.

In a cycle process for the production of carbon monoxide-hydrogen mixtures by the reaction of methane with a reducible metal oxide (e.g. iron oxide), use of alkali metal oxide added to the oxide is claimed to reduce carbon black formation. Operating temperatures for the process lie in the range, 1850 to 2300° F.

C. H. Riesz

Synthetic Plastics

Murphree, E. V. SYNTHETIC PLASTICS, FIBERS, AND RUBBERS—FROM PETROLEUM. *Oil Gas J.* 49, 222, 224, 227, 232, 237, 240, 243-244 (1950) *July* 27.

Approximately 2 million tons of raw materials for synthetic organic chemicals are produced yearly from petroleum and natural gas. Various plastics, fibers and rubbers now in production are described and their uses are briefly reviewed.

C. H. Riesz

7. ANALYTICAL METHODS AND TESTS

Gas Analysis

Ferguson, H. E. WHAT GOOD IS A GAS ANALYSIS? Paper presented at the American Gas Association Production and Chemical Conference at New York, N. Y., May 22-24, 1950.

A method to be employed for interpreting the results of gas analyses is described and several examples of its application are given. The use of this method aids in the detection of operating faults in gas manufacturing processes and indicates or defines the nature of the problem confronting the operator, who must devise and apply a solution on the basis of information supplied by the gas analysis interpretation.

H. Hakewill

Happel, W. J. and Coggeshall, N. D. INSTRUMENTATION AND AUXILIARY EQUIPMENT FOR AUTOMATIC INFRARED GAS ANALYZERS. *Instruments* 23, 552-556 (1950) *June*.

The construction of a continuous flow infrared gas analyzer using a commercially available optical tank is discussed. Descriptions and diagrams of the associated gas-handling and gas-blending systems are included, and careful consideration is given to the electrical circuits and recording equipment.

D. V. Kniebes

Reed, J. B. PORTABLE UNIT FOR GAS ANALYSIS BASED ON THE CONSTANT VOLUME PRINCIPLE. *Fuel* (British) 29, 117-118 (1950) *May*.

A modified Bone and Wheeler gas analysis apparatus of the constant volume type is illustrated and described. This unit is claimed to be simple in operation and requires only a supply of water and of gas or electricity. A minimum number of stopcocks are employed and the design of the analyzer is such that it can be dismantled and reassembled with ease.

H. Hakewill

Gas Oils

Clerc, R. J., Kincannon, C. B. and Wier, T. P., Jr. CHROMATOGRAPHIC ANALYSIS OF GAS OILS FOR HYDROCARBON TYPES. EXAMINATION OF TECHNIQUES. *Anal. Chem.* 22, 864-867 (1950) *July.*

In analyzing mineral oils, gas oils, etc., in terms of groups of molecules of the same hydrocarbon type, it is desirable to separate the sample into fractions, each of which contains a single hydrocarbon type. Of the separation processes useful for this purpose, chromatography is outstanding. Three chromatographic methods of analysis were examined in a study of the hydrocarbon type composition of a straight-run gas oil and a catalytically cracked gas oil. The use of a weak developer to displace a saturate band and to elute several aromatic bands allows the desired separations into saturates, monocyclic aromatics, dicyclic aromatics, and tricyclic aromatics. Moreover, the fractions so recovered are suitable for further characterization by measurement of spectral and other physical properties.

Authors' abstract

Natural Gas

Shepherd, M. ANALYSIS OF NATURAL GAS: COMPARISON OF TWO CHEMICAL METHODS. *Anal. Chem.* 22, 881-885 (1950) *July.*

Two volumetric methods of absorption-combustion are compared by studying the results of the analysis of a standard sample of the natural gas type. One depends upon the measurement of contraction on burning and carbon dioxide produced; the other adds to these the measurement of oxygen consumed. The latter method, not in general use, is shown to be the more accurate. The analyses were performed by laboratories cooperating with Subcommittee VII of Committee D-3 of the American Society for Testing Materials.

Authors' abstract

Oxygen

Richardson, R. E. (assigned to Republic Flow Meters Co.) APPARATUS FOR MEASURING THE COMPOSITION OF A GAS. U.S. 2,511,-177 (1950) June 13.

A device for continuously measuring the oxygen content of a burned gas is disclosed. The apparatus depends upon measuring the conductivity of a flame resulting from combustion of the gas with a combustible gas. A flow diagram illustrating arrangement of apparatus is presented.

H. Hakewill

Sulfur in Coal

Mott, R. A. RAPID DETERMINATION OF PYRITIC AND SULFATE SULFUR IN COAL. *Gas World* (British) 132, *Supplement* 66-67 (1950) *July* 1.

Modifications of the standard method shorten the time of the determination and increase its accuracy. The sulfate sulfur is removed from coal ground to pass 72 B.S. mesh by digesting for 30 min. in 16% HCl at the boiling point, and determining sulfur by precipitation. The pyrites are removed by digesting with boiling 2N HNO_3 for 30 min., and titrating the iron with potassium dichromate using sodium diphenylamine sulfonate as an internal indicator. The non-pyritic iron in the HCl extract is deducted from total iron in HNO_3 extract to calculate the pyritic sulfur.

W. E. Ball

Sulfur Traces

Holeton, R. E. and Linch, A. L. DETERMINATION OF TRACES OF SULFUR IN ORGANIC COMPOUNDS. *Anal. Chem.* 22, 819-822 (1950) *June.*

Improvements in the method for the determination of 1 to 200 p.p.m. of sulfur in organic compounds by combustion with excess air in a heated tube have provided a satisfactory means for the analysis of solids and liquids which are difficult to analyze by conventional methods. The principle of the method is well established, but the design of an atomizer to deliver the sample as fine spray in a stream of air to the combus-

tion zone at an easily controlled rate, and improvements in the absorption of sulfur dioxide and nephelometric determination of sulfur as barium sulfate now permit wider application of this principle. Better absorption of oxides of sulfur has been obtained by condensing water from the combustion in a chilled trap containing sodium perborate solution before passing the gases through absorbers. Precipitation from ammoniacal solution, in the presence of gum arabic as a stabilizer, improved the stability of the barium sulfate colloid. The method has been successfully applied to liquids such as cetane, decahydronaphthalene, *o*-nitroanisole, benzaldehyde, xylidine, and diethylaniline, and solution of solids, such as naphthalene, dinitrobenzene, nitronaphthalene, and *p*-nitrophenetol. Accuracy of the order of 5 to 10% of the amount of sulfur present and a precision of ±2 parts in the range 2 to 100 p.p.m. of sulfur have been attained with both volatile and nonvolatile sulfur sources.

Authors' abstract

Unsaturated Hydrocarbons

Towler, J. H. and Wood, J. W. DETERMINATION OF THE TOTAL UNSATURATED HYDROCARBONS IN FUEL GASES. *Fuel* (British) 29, 159-163 (1950) *July*.

The simultaneous absorption of ethylene and benzene by 98% H_2SO_4 activated with either 0.6% Ag_2SO_4 or 0.2% CrO_3 is demonstrated. Standardized operating conditions are proposed for conducting analytical determinations utilizing these reagents and a method is derived for making corrections necessitated by the adventitious absorption of carbon monoxide during the determination. A scheme for complete analysis of manufactured gas by means of absorption and combustion techniques is presented.

H. Hakewill

Water Gas

Shepherd, M. ANALYSIS OF A CARBURETED WATER GAS BY VOLUMETRIC CHEMICAL METHODS AND BY MASS SPECTROMETER. *Anal. Chem.* 22, 885-889 (1950) *July*.

Fifty-one laboratories throughout the country have analyzed a standard sample of the carbureted water gas type by the conventional volumetric chemical methods and the mass spectrometer. The analytical data are compared in a series of frequency distribution plots which show the strong and weak points of these totally different methods.

Author's abstract

8. GENERAL AND PHYSICAL CHEMISTRY

Adsorption

The following papers were presented at the Adsorption Symposium before the Division of Petroleum Chemistry (Joint with the Divisions of Analytical and Micro Chemistry, Industrial and Engineering Chemistry, and Physical and Inorganic Chemistry) at the 116th Meeting of the American Chemical Society, Atlantic City, N. J., September, 1949.

Eagle, S. and Scott, J. W. LIQUID PHASE ADSORPTION EQUILIBRIA AND KINETICS. *Ind. Eng. Chem.* 42, 1287-1294 (1950) *July*.

Simple experimental and tabular methods of studying adsorption equilibria involving binary liquids and solid adsorbents are described. The use of the toluene-isooctane binary system to evaluate adsorbents is recommended. Theoretical and experimental methods for the study of the kinetics of adsorption are also described.

S. Katz

Lewis, W. K., Gilliland, E. R., Chertow, B. and Cadogan, W. P. ADSORPTION EQUILIBRIA HYDROCARBON GAS MIXTURES. *Ind. Eng. Chem.* 42, 1319-1326 (1950) *July*.

Adsorption equilibrium for a ternary and several binary hydrocarbon systems have been studied over pressures between 0.33 and 20 atmospheres and temperatures between 0 and 40 C on silica gel and several activated carbons. In all cases mutual interference occurred, the amount of each constituent adsorbed from the mixture being less than for the pure separate component. Correlations based on pure gas isotherms are discussed. A concise set of conclusions on the general principles governing adsorption of mixtures is given.

S. Katz

Lewis, W. K., Gilliland, E. R. Chertow, B. and Cadogan, W. P. ADSORPTION EQUILIBRIA PURE GAS ISOTHERMS. *Ind. Eng. Chem.* 42, 1326-1332 (1950) *July.*

The adsorption equilibria for eight of the hydrocarbons from methane to the butanes were measured. Most of the work was at 1 atmosphere and 25° C, but a few cases were studied at pressures up to 20 atmospheres and 250° C. A generalized correlation was derived from a modification of the Polanyi adsorption theory.

S. Katz

Ray, G. C. and Box, E. O., Jr. ADSORPTION OF GASES ON ACTIVATED CHARCOAL. *Ind. Eng. Chem.* 42, 1315-1318 (1950) *July.*

Equilibrium adsorption data were obtained for eleven gases on cocoanut charcoal at pressures between 0 and 215 psia at temperatures between 100 and 450° F. Gases studied were hydrogen, nitrogen, carbon monoxide, carbon dioxide, methane, acetylene, ethylene, ethane, propylene, propane and n-butane. Experimental procedures and equipment are described.

S. Katz

Natural Gas

McCarthy, E. L., Boyd, W. L., and Reid L. S. THE WATER VAPOR CONTENT OF ESSENTIALLY NITROGEN-FREE NATURAL GAS SATURATED AT VARIOUS CONDITIONS OF TEMPERATURE AND PRESSURE. T.P. 2914 *Trans. AIME* 189, 241-243; *J. Petroleum Technol.* 2, (1950) *August.*

A graph of saturation humidity as a function of temperature and pressure for natural gases of low nitrogen content is presented. The temperature range is −60 to + 280° F and the pressure range is atmospheric to 6,000 psia.

J. D. Parent

Porter, J. A. and Reid, L. S. VAPOR-LIQUID EQUILIBRIUM DATA ON THE SYSTEM NATURAL GAS-WATER-TRIETHYLENE GLYCOL AT VARIOUS TEMPERATURES AND PRESSURES. T.P. 2848 *Trans. AIME* 189, 235-240; *J. Petroleum Technol.* 2, (1950) *August.*

Triethylene glycol has been investigated as a dehydration medium for natural gas and adequate design data have been obtained in the temperature range of 60 to 100° F and in the pressure range of atmospheric to 2,000 psi. Triethylene glycol has some advantages over the more widely used diethylene glycol, being superior in thermal stability, dew point depression and lower loss by vaporization. Dew point depression drops off when the pressure exceeds 500 psi and the practical limit is about 1,500 psi.

J. D. Parent

Thermal Conductivity

Lindsay, A. L. and Bromley, L. A. THERMAL CONDUCTIVITY OF GAS MIXTURES. *Ind. Eng. Chem.* 42, 1508-1511 (1950) *August.*

An equation has been developed for the determination of the thermal conductivities of gaseous mixtures, of a form similar to the classical Sutherland equation for viscosities of gaseous systems. The method requires a knowledge of the boiling points and molecular weights of the pure constituents, and either their conductivities, viscosities or heat capacities. A group of 85 binary systems showed an average deviation of 1.9%. Calculations involving hydrogen appear to be the most inaccurate.

S. Katz

Vapor Pressure Equation

Thodos, G. VAPOR PRESSURES OF NORMAL SATURATED HYDROCARBONS. *Ind. Eng. Chem.* 42, 1514-1526 (1950) *August.*

An empirical vapor pressure equation has been developed for the lower normal saturated hydrocarbons which is valid over the entire range from the triple point to the critical point. Development of the equation necessitated separate treatment of the high and low pressure regions which were, however, successfully combined in a single equation involving five arbitrary constants. The average error of the method is 0.2%.

S. Katz

Water Sorbed on Charcoal

McDermot, H. L. and Tuck, N. G. M. THE DENSITY OF WATER SORBED ON CHARCOAL. *Can. J. Research* 28B, 292-297 (1950) *June*.

The apparent volume of water sorbed by a zinc chloride activated charcoal has been measured over the entire range of relative pressures, employing an apparatus especially designed to eliminate carry-over of water vapor into the sorption cell. The apparent volume has been found to be consistently greater over the entire sorption isotherm than the normal volume of an equal weight of liquid water, and it tends to be slightly higher on desorption than on adsorption. The results are in qualitative agreement with those of Wiig and Juhola and in marked disagreement with those of Morrison and McIntosh.

Authors' abstract

10. CHEMICAL ENGINEERING

Adsorption and Extraction

The following papers were presented as the Sixteenth Annual Chemical Engineering Symposium before the Division of Industrial and Engineering Chemistry of the American Chemical Society at the Ohio State University, Columbus, Ohio, December 29-30, 1949.

Bedingfield, C. H., Jr. and Drew, T. B. ANALOGY BETWEEN HEAT TRANSFER AND MASS TRANSFER A PSYCHROMETRIC STUDY. *Ind. Eng. Chem.* 42, 1164-1173 (1950) *June*.

The formal basis of the analogy is given in two equations derived from a careful theoretical study. Psychrometric data were obtained using "wet bulbs" of volatile solids. The solids used were naphthalene, camphor, *p*-dichlorobenzene, and *p*-dibromobenzene. These were cast into solid cylinders with diameters of .375 and .72 in. and lengths of 3.5, 4.5 and 6.75 in., although not all sizes were used with every solid. These cylinders were mounted singly, with axis vertical, in a 1 x 1 ft air duct. The ratios of mass and heat transfer coefficients were calculated from wet and dry bulb data using a simple equation, correction for radiation being made. In addition to the authors' data, the results of several other investigators have been studied for purpose of comparison with the analogy. The Schmidt number raised to the −0.56 power is shown to enter the equation for the ratio of mass to heat transfer coefficient. A j-factor plot for both heat and mass transfer using the data of the authors and three other investigators is given. The powers on both the Schmidt and Prandtl numbers are given as 0.56.

C. L. Tsaros

Gaffney, B. J. and Drew, T. B. MASS TRANSFER FROM PACKING TO ORGANIC SOLVENTS IN SINGLE PHASE FLOW THROUGH A COLUMN. *Ind. Eng. Chem.* 42, 1120-1127 (1950) *June*.

In order to provide a correlation for mass transfer from a packed bed to a liquid flowing through it analogous to those available for gases, measurement of the rate of dissolution of slightly soluble solids in suitable solvents were made for systems of substantially different Schmidt numbers. Solids used were 0.25 in., 0.375 in. and 0.5 in. pellets of organic acids. A 3 in. diameter glass tower packed to heights of 5 to 40 pellet diameters was used. The systems were acetone-succinic acid, benzene-salicylic acid, and n-butyl alcohol-succinic acid. The range of Schmidt numbers was from 159 to 13,-260. Results were expressed in terms of height of a transfer unit (H.T.U.) and curves of this quantity vs Reynolds number are given. At lower Reynolds numbers (< 150), differences were noted with 0.375 in. and 0.5 in. pellets between runs with liquid flowing upward and liquid flowing downward, the latter giving lower H.T.U. values. This was attributed to the effect of free convection, which in the case of upflow acted adversely because of the downward streaming of the more dense concentrated solution. H.T.U. is proportional to the Schmidt number raised to the 0.58 power. Incorporating the data of McCune and Wilhelm for the system water-2-naphthol with that for the above three systems a general correlation for liquid-solid systems is presented. Comparison is made with correlations for gas-solid systems. For a given liquid, moderately good agreement is obtained

between the two groups by suitable choice of the power on the Schmidt number. If the power differs significantly from 0.58, correlation between various liquids will be poor. Further work with gases is called for.

C. L. Tsaros

Lapidus, L. and Amundson, N.R. STAGEWISE ABSORPTION AND EXTRACTION EQUIPMENT: TRANSIENT AND UNSTEADY STATE OPERATION. *Ind. Eng. Chem.* **42**, 1071-1078 (1950) *June*.

Until recently, calculations involved in the stagewise chemical engineering unit operations have been concerned with steady state operation. The authors have considered unsteady state absorption and extraction. Constant inert rate in the feed is assumed, with varying feed composition. Assuming that a linear equilibrium relation obtains between the two phases, formulas are derived to show how compositions will vary with time on any plate. Both countercurrent and co-current absorption are included. The treatment is mathematical and no experimental data are included.

C. L. Tsaros

Licht, W., Jr. and Conway, J. B. MECHANISM OF SOLUTE TRANSFER IN SPRAY TOWERS. *Ind. Eng. Chem.* **42**, 1151-1157 (1950) *June*.

Three separate stages of extraction exist in the life of each drop during spray tower operation: (1) the period of drop formation; (2) the period of drop fall or rise through the continuous phase from the time it leaves the forming tip until it strikes the interface at the opposite end of the tower; (3) crossing the interface. Two 47 mm columns were used: one which permitted determination of the extraction occurring during all three stages, and the other the extraction occurring in the first two stages. The dispersed phase was 6% by weight solution of acetic acid in water. The continuous phase was one of three solvents, isopropyl ether, methyl isobutyl ketone, and ethyl acetate. Curves are given showing per cent acid extracted vs column height, 3 to 30 in. for each solvent used. Extrapolation of the curves for column one to zero height gives the extraction occurring in stages one and three, and extrapolation of the curves for column two to zero height gives the extraction occurring in stage one. At drop formation times above one second, the amount of solute extracted at a given column height is independent of this variable. The amounts of acid lost during drop formation are 5, 8, and 17% respectively, using isopropyl-ether, methyl isobutyl ketone, and ethyl acetate. These values are much less than when the direction of extraction is reversed, the greater forces of adhesion between the water and the acid being given as the reason.

C. L. Tsaros

Shulman, H. L. and Molstad, M. C. GAS-BUBBLE COLUMNS FOR GAS-LIQUID CONTACTING. *Ind. Eng. Chem.* **42**, 1058-1070 (1950) *June*.

The performance of gas-bubble columns has been studied using three glass columns 1 in., 2 in., and 4 in. diameters, respectively, and with column heights varying from 1 to 4 ft. The variables studied included: gas rate, liquid rate, water temperature, column diameter, column height, plate porosity, liquid diffusivity, and desorption, compared with absorption. Several porous plates were used to produce the bubbles and no difference in column behavior was found when operated with the coarsest or finest porous plates. Two distinct fluid conditions or regions were found in the study: at low gas rates, the streamline region where the rate of mass transfer is a function of the gas rates, and at high gas rates, the turbulent region, where it is independent of gas rate. The transition region between the above two conditions varies with the liquid rate. The H.T.U. was found to vary with the 0.26 power of column height and to be independent of column diameter. H.T.U. was found to decrease with temperature in the streamline region and to increase with temperature in the turbulent region. For both streamline and turbulent regions the H.T.U. was found to increase linearly with the liquid rate. For the streamline region, the H.T.U. is proportional to the -0.25 power of liquid diffusivity and for the turbulent region the H.T.U. is proportional to the -0.86 power of the liquid diffusivity. Performance is considered the same for both absorption and desorption.

C. L. Tsaros

Surosky, A. E. and Dodge, B. F. EFFECT OF DIFFUSIVITY ON GAS-FILM ABSORPTION COEFFICIENTS IN PACKED TOWERS. *Ind. Eng. Chem.* **42**, 1113-1119 (1950) *June.*

Using an 8 in. diameter tower packed with one-in. carbon Raschig rings, rates of vaporization of pure liquids into air were measured. Initial runs were made with liquid rate varying from 430 to 5000 lbs/hr x ft² at packed heights of 4, 6, and 12 in. The coefficient $k_g a$ was found to be independent of liquid rate above 1000 lbs/hr x ft² and column end effects were found by a trial process to be equivalent to a packed height of 2.2 in. The bulk of the experiments were performed with a packed height of 4 in. and a liquid rate of 1600 lbs/hr x ft², with air as carrier gas. From vaporization runs using the liquids water, methanol, benzene, ethyl n-butyrate, $k_g a$ was found to vary with the 0.72 power of gas mass velocity and the .15 power of the diffusivity. The effect found for diffusivity assumes the same interfacial area for the four liquids.

C. L. Tsaros

Weisman, F. and Bonilla, C. F. LIQUID-GAS INTERFACIAL AREA IN PACKED COLUMNS. *Ind. Eng, Chem.* **42**, 1099-1105 (1950) *June.*

Air was humidified in a column 4 in. in diameter packed to a depth of 8 in. with ½ in. spheres, both glass and brass spheres. Results were correlated by equations for the height of a transfer unit for both heat and mass transfer. Correction was made for end effects in the experimental apparatus. By dividing the above equations for solid spheres into those of Gamson, Thodos and Hougen for completely wetted spheres, the ratio of effective gas-liquid interfacial area to total packing area was obtained. The effective area for heat transfer is roughly two to four times that for mass transfer, but increases more slowly with both increasing gas and liquid rates than does the area for mass transfer. These differences are explained by the fact that there is heat conduction from the gas to the dry packing and then through the packing to the liquid in parallel with the direct transfer from gas to liquid. In the case of mass transfer, only the latter mechanism exists. Increasing gas and liquid rates enhance the direct transfer without affecting or at the expense of the indirect path and hence cause a greater percentage increase in effective area for mass transfer than for heat transfer. Combining the equations of Taecker and Hougen for completely wetted Raschig rings with those of McAdams, Pohlenz, and St. John for carbon Raschig rings gave results strikingly similar to those above. The fractional effective area for the rings is higher than for spheres at the same gas and liquid Reynolds numbers. It is suggested that experimental values of $k_g a$ for gas film controlled processes in packed columns be divided by the effective interfacial area before attempting to correlate them with the operating variables.

C. L. Tsaros

Adsorption in Fluidized Beds

Kasten, P. R. and Amundson, N. R. AN ELEMENTARY THEORY OF ADSORPTION IN FLUIDIZED BEDS. *Ind. Eng. Chem.* **42**, 1341-1346 (1950) *July.*

Adsorption in a fluidized bed is considered assuming uniform, porous spheres as the adsorbent medium moving in random fashion in a bed supported by a fluid of uniform concentration. Equations are developed for two cases, namely; (a) diffusion controlling with equilibrium attained within the spheres according to an assumed linear isotherm, and (b) adsorption controlling, resulting in non-equilibrium conditions, for which case a reversible kinetic relation was assumed. Sample calculations are included.

C. Von Fredersdorff

Condenser Design

Gloyer, W. THERMAL DESIGN OF CONDENSERS. *Ind. Eng. Chem.* **42**, 1361-1369 (1950) *July.*

An analysis of the problems encountered in the rating of condensers has been made. The subjects discussed are heat release, effective mean temperature difference betwen condensing vapor and cooling medium, rate of heat transfer, pressure drop through condenser shells. Eqqations are derived for the amount of heat release for the cases of total condensation, partial condensation, and partial condensation in

the presence of steam. Effect of partial condensation is to make for an improved mean temperature difference for the vapor and lowered mean temperature difference for the liquid. Correction for varying temperature differences on the condensing coefficient is made. It is shown that resistance to sensible cooling of the condensate is only 0.65 that of condensate layer thickness. Cooling of vapor is calculated by assuming a vapor coefficient obtained by dividing the vapor film coefficient for zero condensation by the fraction of uncondensed vapor in the exchanger. No consideration of the effect of diffusion on partial condensation is made.

C. L. Tsaros

Fluid Flow

Morgan, F., McDowell, J. M. and Doty, E. C. IMPROVEMENTS IN THE X-RAY SATURATION TECHNIQUE OF STUDYING FLUID FLOW. T.P. 2881. Trans. AIME **189**, 183-194; *J. Petroleum Technol.* **2** (1950) *July.*

Improvements in the X-ray method of measuring liquid saturation and saturation distribution are discussed. An improved technique is described whereby the fluid distribution along the length of cores can be obtained when one fluid is displaced by another.

J. D. Parent

Nord, M. GRAPHS CAN AVERT TRIAL AND ERROR IN MANY FLUID FLOW COMPUTATIONS. *Chem. Eng.* **57**, 112-115 (1950) *August.*

By rearranging the Fanning equation and combining with the friction-factor plot, five graphs are presented to enable the solution of fluid flow problems without trial and error. The five cases are: calculation of flow rate where head loss is known; calculation of pipe size where head loss and flow rate are known; calculation of flow rate from a pipe discharging with unknown velocity head; calculation of pipe size when discharging with unknown velocity head; calculation of pipe size where there are pipe fittings in the line.

C. L. Tsaros

Fractionation

Scofield, R. C. INDUSTRIAL FRACTIONATING TOWER PACKING. *Chem. Eng. Progress* **46**, 405-414 (1950) *August.*

A new type fractionating packing has been developed and tested. This packing employs trays superimposed to form a honeycomb-like assembly, each tray being fabricated from seven layers of $^3/_8$-in. diamond mesh metal lathe. Capacity studies indicate permissible loadings of 250% to 300% of one-inch Raschig rings and Berl saddles and 180% of bubble cap towers with 1.5 feet spacing. Fractionation experiments at atmospheric pressure, 180 mm pressure, and 160-170 psia were made. At optimum conditions of operation under atmospheric pressure, the packed tower enjoys a 2.9-fold advantage in "H.E.T.P." and 2.1-fold advantage in capacity over the bubble tray column with 1.5 foot tray spacing, thus making for only one-sixth the required tower volume. Under vacuum operation the comparative "H.E.T.P." values are about the same, but loading capacity of the packing is about three times that of the tray. Tests under pressure showed the packing to have an "H.E.T.P." ratio advantage of 1.47-fold with a 1.34-fold capacity advantage giving a volume advantage of two-fold. Under comparable conditions, liquid holdup for the packing is about one-seventh that of the trays. Considering the six-fold maximum volumetric efficiency advantage observed for the packing, the fractionating section cost of a bubble plate column is 5.4 times that of the packed column.

C. L. Tsaros

Pressure Drop

Brownell, L. E., Dombrowski, H. S. and Dickey, C. A. PRESSURE DROP THROUGH POROUS MEDIA. IV. NEW DATA AND REVISED CORRELATION. *Chem. Eng. Progress* **46**, 415-422 (1950) *August.*

New data on pressure drop through porous media covering a wide range of flow conditions and bed porosity permit a correlation which is somewhat more accurate than those previously presented. Particle shape, grain size and porosity are of considerable importance. Consolidated media were not tested.

J. D. Parent

Thermal Conductivity

Hooper, F. C. and Lepper, F. R. TRANSIENT HEAT FLOW APPARATUS FOR THE DETERMINATION OF THERMAL CONDUCTIVITIES. *Heating, Piping, Air Conditioning* 22, 129-134 (1950) *August*.

A portable instrument for the determination of the thermal conductivities of both wet and dry materials has been developed. It is an out-growth of studies of the thermal conductivity of moist soils. The use of a hot plate method does not give sufficient accuracy because of moisture migration resulting from the temperature difference across the hot plate, and because of the problem of obtaining structurally undisturbed soil specimens. The instrument is a probe, consisting of an aluminum tube, inside of which there is an axial constantan electrical resistance wire, which provides a heat source. The instrument approximates a line heat source of constant strength in an infinite homogeneous body initially at uniform temperature. Application of the Fourier equation to time-temperature data permits calculation of thermal conductivity with accuracy believed sufficient for engineering use.

C. L. Tsaros

The following articles, the abstracts for which appear on the pages indicated, are also called to your attention:

ADSORPTION SYMPOSIUM. p. 177

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Flanges

Lewis, O. L. HERE'S THE WHAT, WHEN, WHERE, WHY OF FLANGES. *Oil Gas J.* 49, 88, 91, 135-136 (1950) August 17.

The reasons for the use of the various types of flanges are presented. The integral flange on valves etc., allows shorter face to face dimensions. Lap joint flanges make for easy alignment. Threaded flanges can be installed where welding is prohibited. A blind flange is just an end closure. The slip-on flange makes for easy alignment and for light weight. A reducing flange is of the slip-on type, but has an inside diameter for a smaller pipe than called for by the flange dimensions. A welding neck flange is the most popular because of ease of installation and because the butt weld is better suited to cyclic loadings and high bending loads than the fillet weld. Some of the factors involved in gasket selection are listed, and the various flange facings are briefly considered.

W. J. Merwin

Metered Control

REFINER'S NOTEBOOK: METERED CONTROL SYSTEMS. *Oil Gas J.* 49, 341 (1950) *July* 27.

Examples are presented of interlocking control and of ratio control. In the case of interlocking control, a liquid level controller on a reflux accumulator resets a flow controller on the reflux stream which serves as feed for a second column. This method makes the fractionating system more stable toward flow rate changes caused by pressure upsets. In the case of ratio control, a temperature controller is used to reset a flow ratio controller through which feed is proportioned to overhead product.

W. J. Merwin

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Charnley, F. S. REMOTE CONTROL AS APPLIED TO CARBURETED WATER GAS PRODUCTION. p. 164

12. MATERIALS OF CONSTRUCTION

Corrosion

Denison, I. A. CORROSION OF MATERIALS OF CONSTRUCTION UNDERGROUND. PART II. *Petroleum Engr.* **22D**, 9-12 (1950) *July.*

The corrosiveness of various soils towards plain steel is discussed. The corrosion of copper and copper alloys is considered. A graphical comparison of the corrosion of various metals exposed to various types of soil is given.

B. E. Hunt

Rohrman, F. A. BIBLIOGRAPHY ON CATHODIC PROTECTION. *World Oil* **131**, 179-180, 182, 184, 186, 188, 190 (1950) *July* 1.

This bibliography contains 400 items and presumes to include all papers pertinent to cathodic protection issued between 1842 and 1949. The items are further classified as to their main subject matter—anodic metals, external electrical circuits, and general subject matter.

B. E. Hunt

Scott, G. N. SOME CHARACTERISTICS OF MASTIC-TYPE PIPE COATINGS. *Oil Gas J.* **49**, 283-286 (1950) *July* 27.

The application of "coating" discontinuity and coating conductance tests to mastic-type pipe coatings is discussed. Tests have indicated the tentative conclusion that a properly constructed, inspected, and tested coating will give satisfactory service even under wet and highly corrosive environments. Cathodic protection as a supplementary safeguard is not needed but may be applied on a small scale.

B. E. Hunt

Wormwell, F. and Ison, H. C. K. CORROSION AND PASSIVATION OF MILD STEEL AT HIGH SPEEDS OF MOVEMENT IN AQUEOUS SOLUTIONS. *Chem. & Ind.* (British) **1950**, 549-550 (*July* 8).

Mild steel samples, under conditions of rapid movement, were found to undergo an initial stage of passivation. The adherence of the outer ferric rust coat seems to be a more critical factor on the rate of corrosion than the variations of speed, nature of surface preparation, changes of salt concentration or changes of temperature.

B. E. Hunt

CRITERIA FOR CATHODIC PROTECTION. *World Oil* **131**, 177-178 (1950) *July* 1.

The basic considerations leading towards the proper method of protecting pipe line installations are described. The economic advantages in combining mechanical and cathodic protection are stressed.

B. E. Hunt

13. NEW BOOKS

Thermodynamic Properties

Sage, B. H. and Lacey, W. N. THERMODYNAMIC PROPERTIES OF THE LIGHTER PARAFFIN HYDROCARBONS AND NITROGEN. *American Petroleum Institute, New York*, 1950.

This monograph is a compilation in consistent form of data obtained on API Research Project 37: "Fundamental Behavior of Lighter Hydrocarbons" carried on at the California Institute of Technology. The compressibility factor, fugacity, enthalpy, and entropy of methane, ethane, propane, *n*-butane, iso-butane, *n*-pentane, and nitrogen are tabulated as functions of temperature and pressure. In most cases, the pressure range is 0 to 10,000 psia and 100 to 460°F. The volumetric and phase behavior of the six systems; methane-ethane, methane-propane, methane-*n*-butane, methane-*n*-pentane, methane-decane, and methane-*n*-butane-decane are tabulated for the above temperature and pressure ranges.

O. T. Bloomer

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